

Introduction to Botany. Lecture 6

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Outline

- 1 Questions and answers
- 2 Meristems
- 3 Vascular tissues
 - Xylem
 - Phloem
- 4 Other tissues
 - Periderm
 - Poikilo- and homoiohydricity
 - Absorption tissues
 - Secretory tissues
 - Additional meristems

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Previous final question: the answer

Please tell the difference between sclereids and sclerenchyma fibers

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Please tell the difference between sclereids and sclerenchyma fibers

- Sclereids: short crystal-like cells
- Fibers: long cells

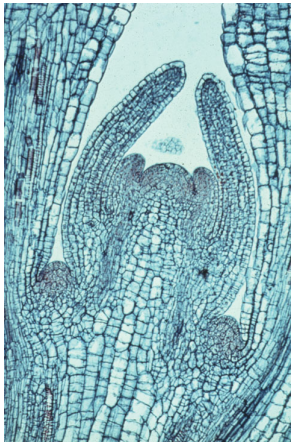
Announcements

- First exam: this Friday
- Two work study positions available

Meristems: apical

- Centers of plant development
- Locate on the very ends of roots (RAM) and shoots (SAM)
- Produce intermediate primary meristems which form all primary tissues

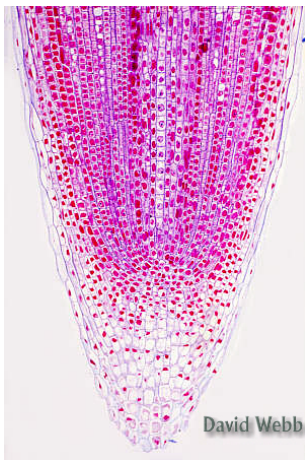
SAM



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Coleus sp. stem apical meristem (LM $\times 100$)

RAM



Corn (*Zea mays*) root apical meristem (© D. Webb)

Lateral meristem: cambium

- Originates from procambium which in turn originates from apical meristems
- Usually arises within vessel bundle or vessel cylinder, right between two vascular tissues
- Main function: produces secondary vascular tissues

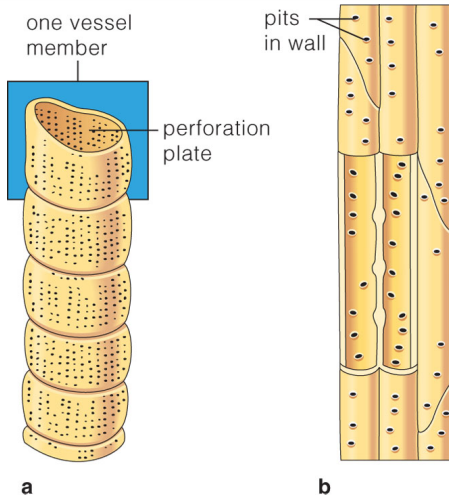
Primary and secondary tissues

- Primary tissues originate from stem or root apex through primary meristems
- Secondary tissues originate from lateral meristems

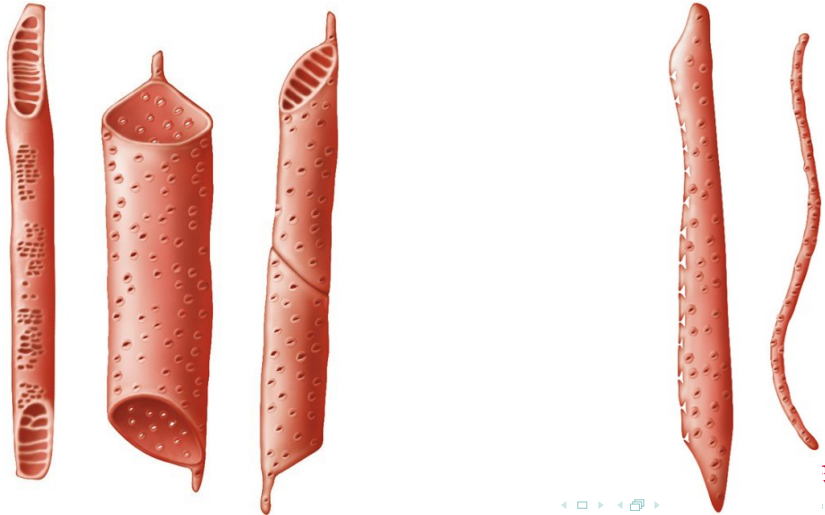
Vascular tissues: Xylem

- Occurs in vascular bundles or vascular cylinder
- Types of cells: tracheary elements (tracheids and vessel members), fibers, and parenchyma
- Tracheids have pits; vessel members have perforations; all of them are dead cells
- Gymnosperms have only tracheids; flowering plants have tracheids + vessel elements together
- In flowering plants, primary xylem has mostly tracheids and vessels with scalariform perforations; secondary xylem has mostly vessels with open perforations
- Xylem elements (except parenchyma) are rich of lignin and are main components of wood
- Main functions: water transport and mechanical support

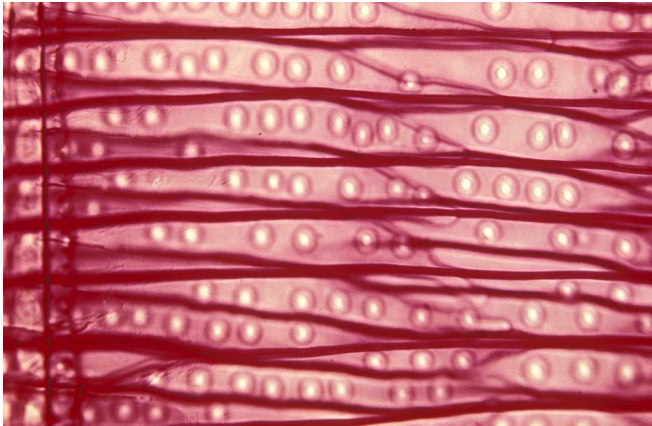
Vessel members vs. Tracheids



Vessel members vs. Tracheids

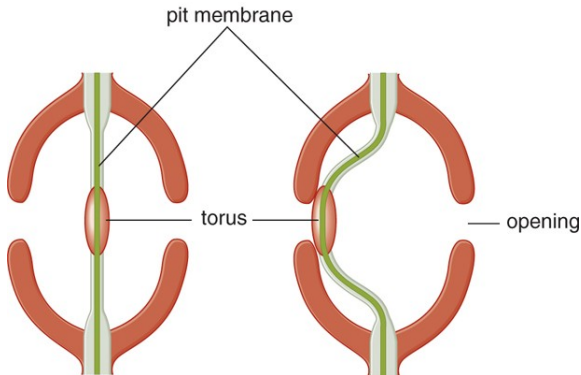


Tracheids



Pine (*Pinus* sp.) tracheids with pits

Pit is NOT a direct connection

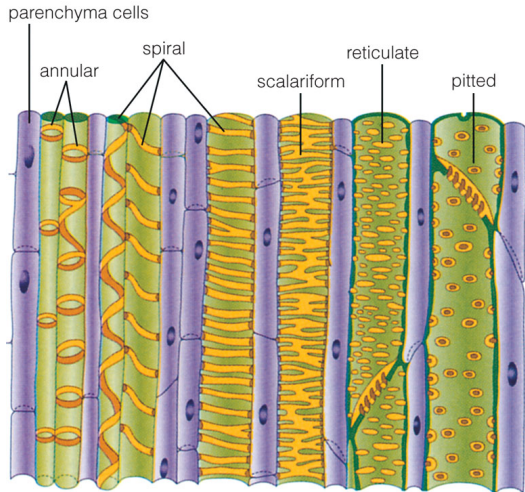


Vessels



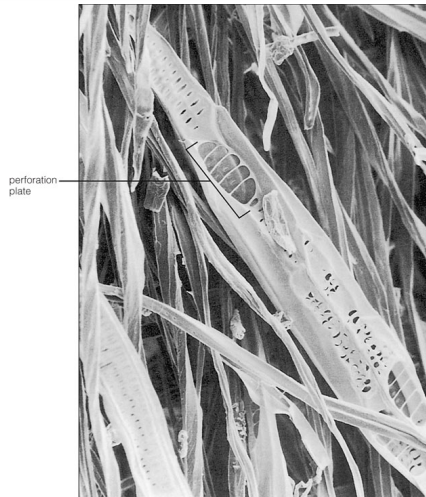
Ash (*Fraxinus americana*) secondary xylem
with vessels (LM $\times 26$)

Perforations



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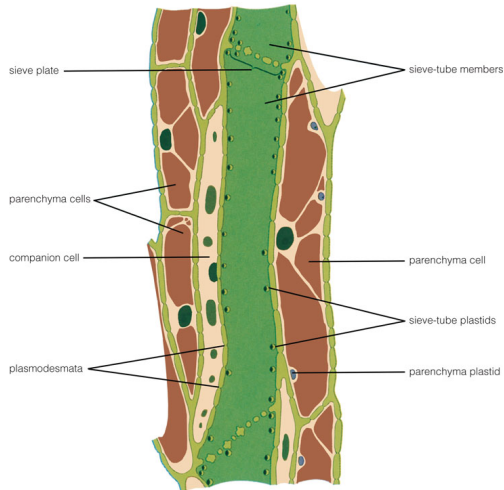
Scalariform perforations: direct connections



Phloem

- Usually occurs adjacent to a xylem
- Types of cells: sieve tube cells, companion cells, fibers and parenchyma
- Sieve tube cells have plastids and perforation (sieve) plates between cells but no nuclei, companion cells have nuclei
- However, in gymnosperms there are *no* companion cells and sieve tube cells *have* nuclei
- Secondary phloem usually has more fibers than primary phloem
- Main functions: sugar transport and mechanical support

Phloem cell types



Sieve tubes and phloem parenchyma

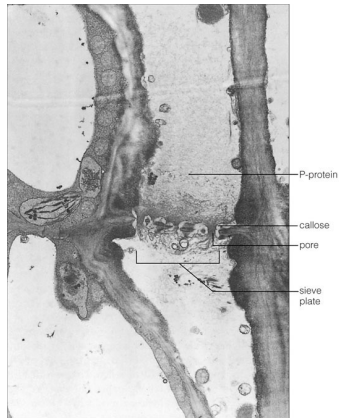
parenchyma cell

sieve-tube member



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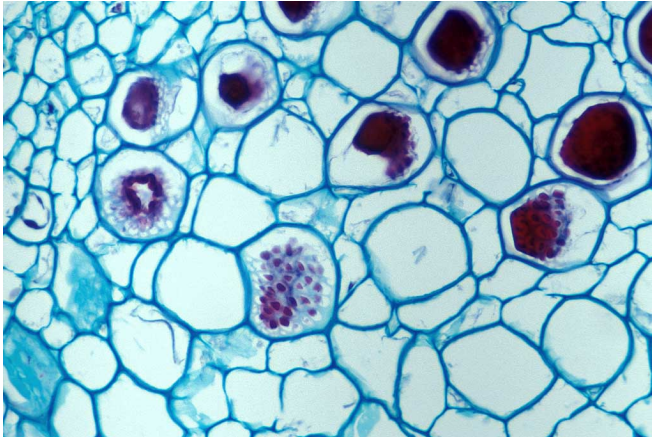
Perforation (sieve) plate



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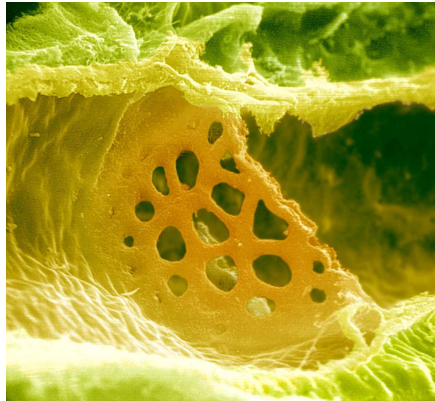
Cross-section (TEM)

Plates: frontal view



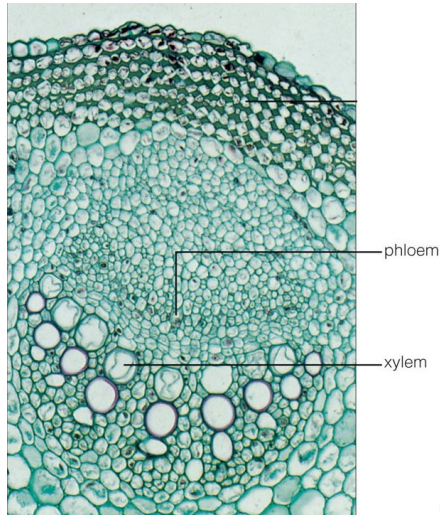
Frontal view (LM)

Plates: pores

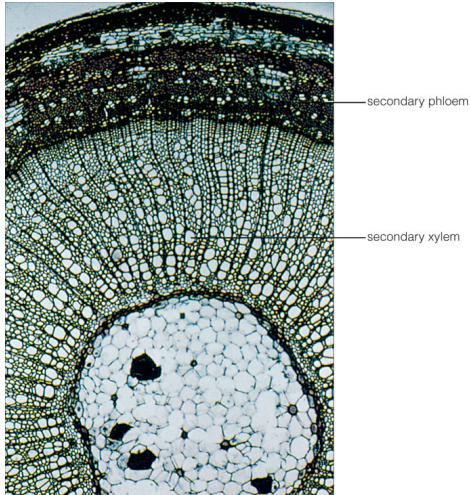


Sieve plate, a pore in the end wall of a sieve-tube member, through which phloem sap flows (SEM $\times 4800$)

Primary vascular tissues



Secondary vascular tissues



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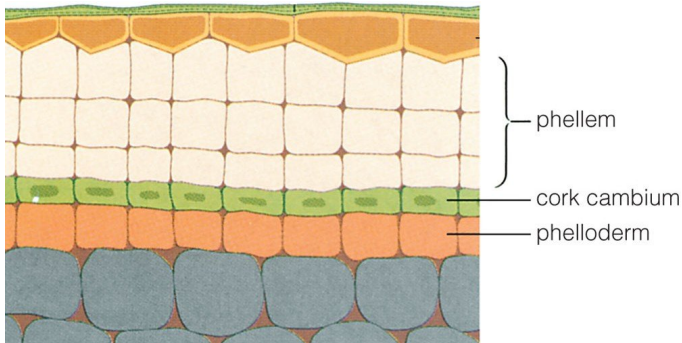
Xylem vs. Phloem

- **State:** dead vs. living cells
- **Transport:** water vs. sugar
- **Direction:** up vs. down
- **Biomass:** big vs. small

Secondary dermal tissue: Periderm

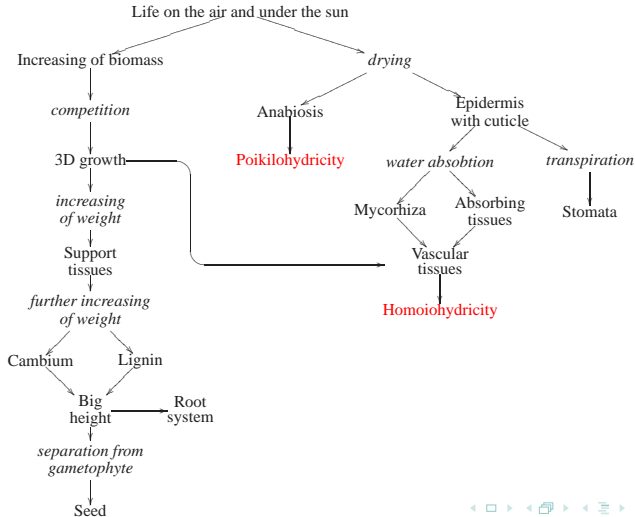
- Secondary dermal tissue
- Arises inside the stem ground tissue, closer to surface (cortex)
- Complex tissue: includes phellem, cork cambium, and phelloderm
- Old periderm includes some other tissues and becomes a cork
- Cells of phellem are dead cells rich of suberin
- Main function is defense

Three cell types of periderm



Cork cambium is another lateral meristem; *phellem* and *phelloderm* are main components of periderm

Origins of poikilo- and homoiohydricity



Absorption tissues

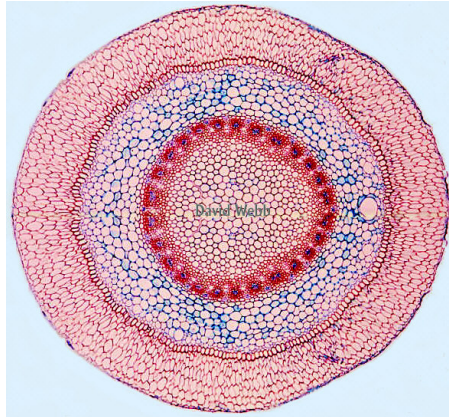
- Always primary, simple tissues
- **Rhizoderm**, or root hairs, originates from protoderm, but life span is much shorter than of epidermis
- **Velamen**, originates from root cortex

Rhizodermm



Root hairs of grass seedlings (LM)

Velamen

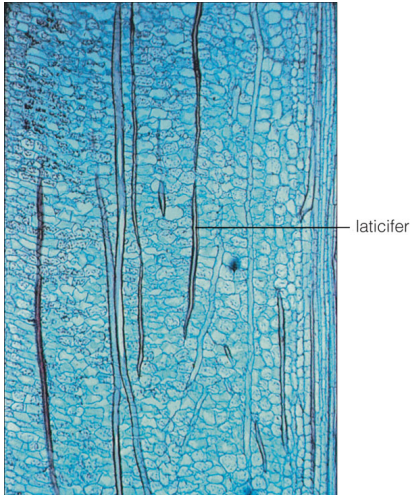


Outer cylinder is a velamen tissue of orchid root (LM, © D. Webb)

Secretory tissues

- Primary, simple or complex tissues
- Spreading across plant body, concentrating in leaves and young stems
- May secrete latex, volatile oils, mucus and other chemicals
- Functions vary: attraction or dis-attraction, communication, defense etc.

Laticifers



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Additional meristems

- **Intercalary** meristems: locate in stems, regulates stem elongation
- **Marginal** meristems are leaf-specific, they regulate leaf shape
- **Repair** meristems help to cure wounds, they form buds and roots in unusual places

Final question (2 points)

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What is common between xylem and phloem?

Summary

- **Meristems** produce all other primary and secondary tissues
- **Vascular** tissues transport water and sugars
- **Periderm** covers stems
- **Homoiohydric** plants have **absorbtion** tissues which take water from soil
- **Secretory** tissues extract different chemicals outside

For Exam 1



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